AN ECOLOGICAL SURVEY OF THE PROPOSED WILLIAM'S POINT RESEARCH NATURAL AREA, SISKIYOU CO., CALIFORNIA

by

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The proposed William's Point Research Natural Area is located on the Klamath River 5 miles east of Happy Camp, California. The 150-acre proposal is on the Klamath National Forest. It includes north and east-facing slopes of a promontory which is surrounded on three sides by the Klamath River. The fourth side is bounded by State Route 96. It roughly corresponds to portions of Sections 7 and 8, T16N, R8E. (Fig. 1).

Topographically the area consists of slope topography which abruptly ends at the edge of the Klamath River. The majority of the slopes are steep, ranging from 60 to 90%. Those at the east end are more moderate, 30 to 50%. Elevation varies from 2250 ft. at the top of William's Point to 1100 ft. at the river's edge. The area is typical low-elevation topography of the upper Klamath River canyon.

Geologically the area is composed of pre-Silurian, metasedimentary rock. Most soils show moderate development. A notable exception is in the central portion where unstable soils are thin and rocky.

Precipitation totals for nearby Happy Camp Ranger Station show a mean annual value over the past 6 years of 46.7 inches. The pattern is typical of the California mediterranean climate. The bulk of the precipitation falls from November to February with occasional winter snows and summer thunderstorms. Mean daily temperatures at the Happy Camp Ranger

Station range from 42.2°F in the winter months to 76.3°F during the warmest, summer months. The climate of William's Point is typical of much of the interior Klamath canyon country of Siskiyou County.

The vegetation of the proposed natural area is composed of old-growth Pseudotsuga menziesii-mixed evergreen forests (Sawyer et al. 1977) on mesic, moderate slopes with better soil development. The more xeric, steep slopes with thin, rocky soil support an open Quercus chrysolepis-Quercus garryana woodland. Both vegetation types show mixed age structure with canopy species well represented in the sapling and seedling layers. The understory shrub and herb layers vary according to the relative moisture relationships as more mesic environments show better developed herb and shrub layers. The Pseudotsuga menziesii-mixed evergreen forests occupy about 80 percent of the proposed research natural area.

METHODS AND MATERIALS

An inventory of vascular plants was started during the preliminary reconnaissance made in late August, 1976. Only specimens of unknown taxa were collected. These plants were then identified at the Humboldt State University Herbarium (HSC), and voucher specimens are deposited there. From this reconnaissance three distinct forest types were proposed for the area, a Pseudotsuga/Toxicodendron forest, a Quercus chrysolepis woodland, and a Pseudotsuga/Lithocarpus forest. Sampling procedures were based on these proposed types.

Determination of forest composition:

After the August reconnaissance, species composition of the canopy, understory, and ground layers were sampled using 40 releves. In representative areas, species cover was estimated using standard techniques (Mueller-Dombois and Ellenberg 1974). Association tables were then developed to determine compositional differences among vegetation types.

Stand analyses:

The three forest types were sampled separately for tree (> 4" dbh) density and basal area. Due to slope steepness the point-centered quarter method was employed (Mueller-Dombois and Ellenberg 1974). Distances were measured by a rangefinder; tree diameters were taped at breast height (4.5'). In the two Pseudotsuga-dominated forests, 50 points were taken along transects which contoured slopes. In the third type, dominated largely by oaks, only 10 points were taken. In all three cases the points were taken every 25 to 50 paces depending on tree density.

Growth rates were calculated for Pseudotsuga menziesii and Pinus ponderosa. The rates (inches year^{-1}) were based on core samples averaging 5 inches in length, taken from 20 vigorously growing canopy trees. The steepness of the slopes inhibited adequately measuring tree heights.

Releves, sampling points for trees, and increment cores were done in late August and early September of 1976. Additional plant collections were also made in early September to complete field sampling.

RESULTS

In the proposed William's Point Research Natural Area some 111 taxa were recognized (Appendix 1). These taxa are typical of low-elevation, Klamath River canyon flora. No sensitive species were found.

Forest composition:

The 40 releves were assembled into a series of association tables to define compositional differences. The concluding presence table (Table 1) illustrates two major vegetation types, the Pseudotsuga menziesii/Achlys triphylla type, and the Quercus/Pityrogramma triangularis type. Within the Pseudotsuga/Achlys type two distinct phases were recognized, the Pseudotsuga menziesii/Polystichum munitum phase and the Pseudotsuga menziesii/Ligusticum californicum phase. Their differences most likely reflect differences in relative available moisture. The more mesic areas support the Pseudotsuga/Polystichum phase which is characterized by a dense lower canopy dominated by Lithocarpus densiflora. Taxus brevifolia, also found in the lower canopy, is restricted to this phase. Although many herbs are common to both phases, relatively few are restricted to either. However, the Pseudotsuga/Polystichum phase appears to be the preferred habitat for Polystichum munitum and others.

The Pseudotsuga menziesii/Ligusticum californicum phase is typical of the relatively drier upper slopes of the area. Here Pseudotsuga still dominates the upper canopy, and Pinus lambertiana is more common than before. Although Lithocarpus is still a component of the lower canopy its importance is significantly reduced to less than 10 percent of the subcanopy coverage.

Also Acer macrophyllum becomes more important in the lower canopy here. While many of the herbs found in the more mesic phase are also found here, this phase has a more distinct herb assemblage with Madia madioides Ligusticum californicum, and Lathrys polyphyllus restricted to it. The most common herbs found in both phases, but restricted to the Pseudotsuga/Achlys type, are Pteridium aquilinum, Disporum hookeri, Galium triflorum, Trientalis latifolia, and Arnica mollis (Table 1).

The second type, Quercus/Pityrogramma triangularis, is quite distinct from the first. It is found only on dry, steep, unstable slopes where the soils are thin and rocky. It is characterized by an open Quercus chrysolepis Quercus garryana-dominated woodland. The herbaceous layer is also quite distinct with xerophytic herbs as Pityrogramma triangularis, Heuchera micrantha, Selaginella sp., Polypodium californicum, and Eriogonum umbellatum common. (Table 1).

Data from the point-centered quarter method samples were used to calculate density and basal area (Table 2). The three sampled entities, based on preliminary divisions, correspond well with the final forest types and phases. The two phases of the Pseudotsuga/Achlys type, the Pseudotsuga/Polystichum phase and Pseudotsuga/Ligusticum phase, have densities of 371 trees $acre^{-1}$ and 140 trees $acre^{-1}$ respectively. The Pseudotsuga/Polystichum phase also has a much greater total basal area (679 $ft.^2$ $acre^{-1}$) than does the Pseudotsuga/Ligusticum phase (275 $ft.^2$ $acre^{-1}$). Pseudotsuga contributes significantly to basal area in both phases; Pinus lambertiana exhibits a ten-fold increase in the Pseudotsuga/Ligusticum phase (2.5 $ft.^2$ $acre^{-1}$ and

(21 ft.^{2} acre^{-1}). It is not a significant forest tree even here, though Table 2 also illustrates the change in importance of Lithocarpus densiflora in terms of both density and basal area between the two phases, (178 trees acre^{-1} and 87 ft.^{2} acre^{-1} in the Pseudotsuga/Polystichum phase; 3 trees acre^{-1} and .6 ft.^{2} acre^{-1} in the Pseudotsuga/Ligusticum phase). In the latter phase it mainly attains only shrub stature.

Data for the Quercus/Pityrogramma type (Table 2) illustrates it as a woodland of small trees. While the number of trees is not drastically lower (128 trees acre^{-1}) than the density of the Pseudotsuga/Ligusticum phase of the Pseudotsuga/Achlys type, a large difference in basal area between the two exists (34 ft.^{2} acre^{-1}).

Productivity estimates were made by counting the number of annual rings for each inch from core samples taken from selected vigorously growing canopy trees. Only Pseudotsuga menziesii and Pinus ponderosa were sampled. It is apparent (Table 3) that mesic slope stands are most productive.

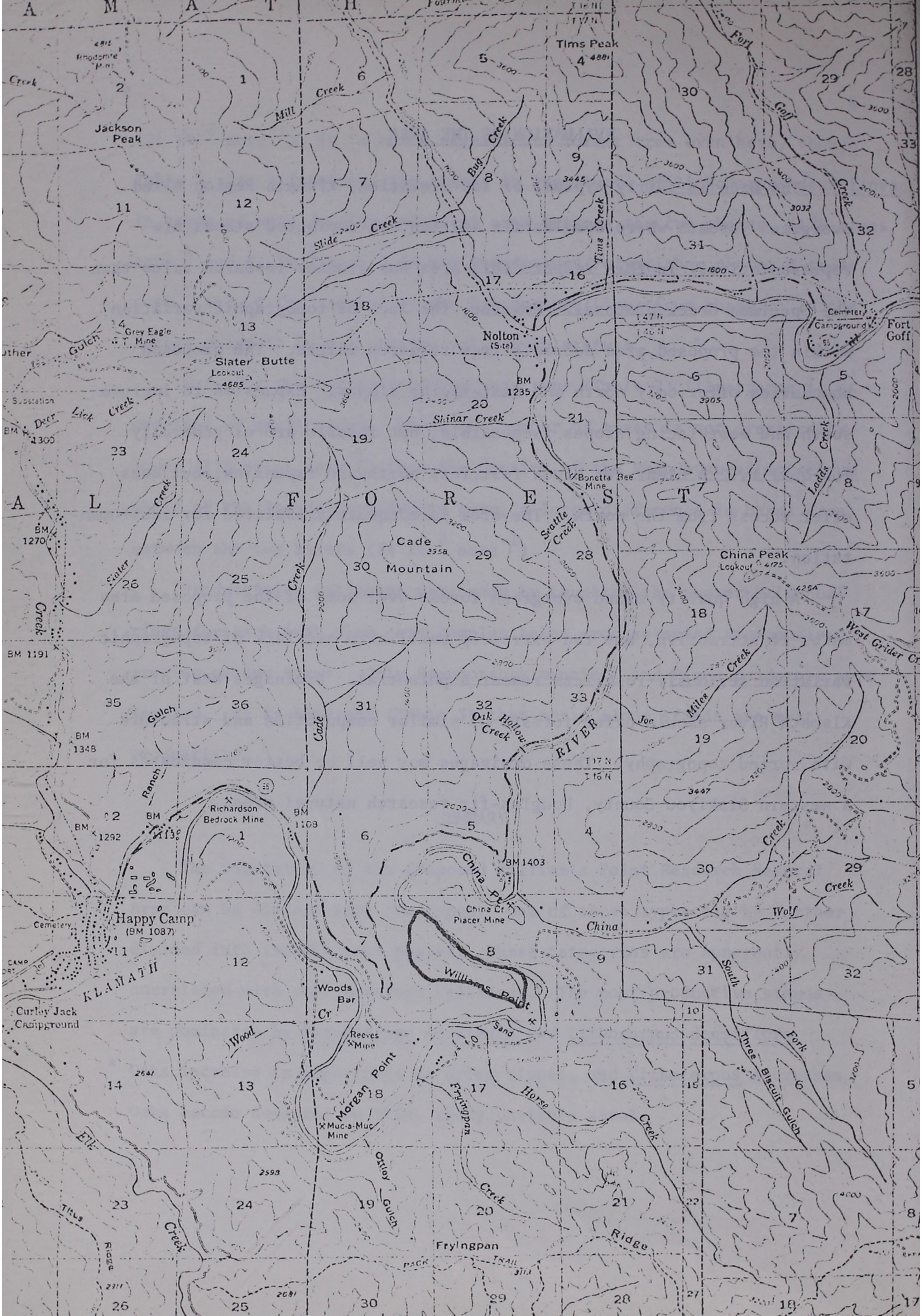
SUMMARY

The vegetation of the proposed William's Point Research Natural Area can be divided into two types. One of these types can be further divided into two distinct phases. These categories are apparently correlated with soil moisture relations. The most productive stands are dominated by Pseudotsuga menziesii and Lithocarpus densiflora. Oaks increase in importance on drier slopes, and Lithocarpus decreases. Oaks become dominant on thin, rocky unstable areas.

EVALUATION OF THE AREA

The area is fairly typical of low-elevation, Klamath Region mixed evergreen forests where Douglas fir and tan oak dominated stands are representative. In this respect this area has greater research value than the Specimen Creek proposal. However, the lack of topographic variation within the proposed area detracts from research values. The proposed boundaries offer only north and east-facing slopes. Expansion to include south and west-facing slopes is possible, but forests are of generally low quality. A clear-cut block restricts northward expansion, but does offer access from the north. The area is adequately isolated for instrumentation.

A high quality mixed evergreen forest over some of the proposed area makes it attractive, but the extremely small size and lack of topographic variation seriously restricts research potential. Drainages west of the Klamath River should offer forests of similar composition and structure with varied topography. These drainages may well be better candidates for a western Siskiyou County, Douglas-fir research natural area.



A M A T H
Tims Peak
4881
Rhodomire Mine
Mill Creek
Jackson Peak
Bug Creek
Slide Creek
Tims Creek
Fort Goff Creek
Grey Eagle Mine
Nolton (Site)
Cemetery
Campground
Fort Goff
Slater Butte
Lookout
4685
Substation
Deer Lick Creek
BM 1300
BM 1235
Shinar Creek
Bonetta Bee Mine
Ladds Creek
A L F O R E S T
BM 1270
Slater Creek
Cade 3958 Mountain
Seattle Creek
China Peak
Lookout 4175
Cade Creek
West Grider Cr
BM 1191
Joe Miles Creek
Gulch
Oak Hollow Creek
RIVER
BM 1348
T 17 N
T 16 N
Ranch
Richardson Bedrock Mine
BM 1108
BM 1292
BM 1403
China Pt
China Cr Placer Mine
China
Wolf Creek
Happy Camp (BM 1087)
Cemetery
KLAMATH
Williams Point
Woods Bar
Cr
Curley Jack Campground
Wood
Reeves Mine
Sand
South Fork
Three Biscuit Gulch
Morgan Point
Muc-a-Muc Mine
Fryingpan
Horse Creek
Elk Creek
Titus Ridge
Ottley Gulch
Fryingpan Creek
Ridge
Fryingpan
PACK TRAIL

Table 1. Presence (P%) and modal cover/abundance (C/A) for all sampled trees and shrubs, and for herbs with > 20% presence. Pseudotsuga menziesii/Achlys triphylla type sampled with 30 releves (each phase with 15 releves), Quercus/Pityrogramma triangularis type with 10 releves. Cover/abundance scale: i = one individual, 2 = rare and <10%, 3 = common and <10%, 4 = 10-25%, 5 = 25-50%, 6 = 50-75%, 7 = 75%. Applicable subspecific nomenclature in Appendix 1.

Type	Pseudotsuga/Achlys				Quercus/Pityrogramma	
Phase	Polystichum		Ligusticum			
Trees, Upper Canopy	%P	C/A	%P	C/A	%P	C/A
Pseudotsuga menziesii	100	5	100	5		
Pinus lambertiana	7	2	20	2		
Quercus chrysolepis					80	3
Arbutus menziesii					40	2
Quercus garryana					90	3
Understory, Lower Canopy						
Pseudotsuga menziesii	100	3	100	5	10	2
Taxus brevifolia	27	3				
Pinus lambertiana	7	1	40	2		
Lithocarpus densiflora	100	5	60	2		
Acer macrophyllum	80	3	53	5		
Cornus nuttallii	80	2	60	3		
Quercus kelloggii	20	2	87	3		
Arbutus menziesii	53	3	87	4	40	2
Quercus chrysolepis	20	3	93	3	90	4
Quercus garryana					80	3
Seedlings						
Pseudotsuga menziesii	80	2	100	3		
Lithocarpus densiflora	100	4	53	2		
Cornus nuttallii	60	2	67	3		
Acer macrophyllum	27	2	20	2		
Pinus lambertiana	13	2	60	2		
Arbutus menziesii	40	2	60	2	10	2
Pinus ponderosa			13	1		
Quercus chrysolepis	60	2	93	3	70	3

Table 1 Continued.

Type	Pseudotsuga/Achlys				Quercus/Pityrogramma	
Phase	Polystichum		Ligusticum			
Shrubs	%P	C/A	%P	C/A	%P	C/A
Berberis nervosa	27	3				
Berberis aquifolium	13	2				
Symphoricarpos hesperius	13	2				
Corylus cornuta	73	3	100	4		
Symphoricarpos mollis	60	2	87	3		
Rosa gymnocarpa	60	2	80	3		
Berberis pinnata	13	2	7	2	10	2
Holodiscus discolor	33	3	33	3	30	3
Amelanchier florida	20	2			10	2
Toxicodendron diversiloba	87	2	100	3	100	5
Amelanchier pallida			53	2	20	2
Ceanothus integerrimus			60	3	20	2
Lonicera ciliosa			7	2	20	2
Philadelphus gordonianus					20	2
Cercocarpus betuloides					30	2
Herbs						
Trillum ovatum	33	2				
Rubus vitifolius	20	2				
Polystichum munitum	87	2	7	1		
Rubus parviflorus	20	2	13	2		
Achlys triphylla	100	3	87	4		
Trientalis latifolia	93	3	67	3		
Disporum hookeri	73	2	73	3		
Pteridium aquilinum	67	2	93	3		
Galium triflorum	60	2	60	3		

Table 1 Continued

Type	Pseudotsuga/Achlys				Quercus/Pityrogramma	
Phase	Polystichum		Ligusticum			
Herbs (cont'd)	%P	C/A	%P	C/A	%P	C/A
Iris tenax	20	2	20	2		
Osmorhiza chilensis	33	2	27	2		
Goodyera oblongifolia	33	2	40	2		
Viola glabella	20	2	27	2		
Arnica mollis	40	2	80	3		
Hieracium albiflorum	20	2	87	3		
Campanula prenathoides	7	2	60	4		
Adenocaulon bicolor	7	1	53	3		
Vancouveria planipetala	7	2	27	2		
Lonicera hispidula	100	3	100	3	50	3
Bromus inermis	7	3	73	3	100	5
Ligusticum californicum			53	3		
Madia madioides			27	3		
Melica bulbosa			20	3		
Lathyrus polyphyllus			20	3		
Polystichum imbricans			67	4	90	2
Dryopteris arguta			7	2	30	2
Pityrogramma triangularis					100	3
Selaginella wallacei					80	4
Polypodium californicum					70	3
Aira praecox					70	4
Heuchera micrantha					60	3
Eriogonum nudum					60	3
Hypericum perforatum					50	2
Cystopteris fragilis					40	2
Eriophyllum lanatum					40	2

Table 1 Continued

Type	Pseudotsuga/Achlys				Quercus/Pityrogramma	
Phase	Polystichum		Ligusticum			
Herbs (cont'd)	%P	C/A	%P	C/A	%P	C/A
Sedum laxum					40	3
Epilobium glaberrimum					30	3
Bromus rigidus					20	2

Table 2. Density (D as trees acre^{-1}) and basal area (BA as ft.^{2} acre^{-1}) for *Pseudotsuga menziesii*/*Achlys triphylla* forest and its phases, and for *Quercus*/*Pityrogramma triangularis* woodland.

	Pseudotsuga/Achlys type				Quercus/Pityrogramma Type	
	Polystichum phase		Ligusticum phase			
Species	D	BA	D	BA	D	BA
Pseudotsuga menziesii	104.0	678.8	80.0	275.2		
Pinus lambertiana	3.7	2.5	1.4	20.6		
Pinus ponderosa			1.4	7.2		
Arbutus menziesii	29.7	19.9	15.4	21.8	3.2	.5
Quercus chrysolepis	7.4	1.7	5.6	1.0	54.2	23.8
Quercus garryana					67.0	10.6
Cercocarpus betuloides					3.2	.3
Quercus kelloggii			18.6	9.6		
Cornus nuttallii	3.7	1.0	2.8	.4		
Acer macrophyllum	33.4	17.6	12.6	9.7		
Lithocarpus densiflora	178.2	87.4	2.8	.6		
Taxus brevifolia	11.4	2.5				

Table 3. Average radial growth rates (years inch^{-1}) for selected canopy trees in the phases of the Pseudotsuga menziesii/Achlys triphylla type. Trees cored at breast height.

Species	Mean radial growth, years inch^{-1} (individual growth rates)
Pseudotsuga menziesii/Polystichum munitum	
Pseudotsuga menziesii	19.6 (16.6, 15.3, 29.8, 12.0, 12.8, 25.6, 22.5, 18.7, 31.6, 10.9)
Pseudotsuga menziesii/Ligusticum californicum	
Pseudotsuga menziesii	17.8 (35.2, 18.2, 19.3, 20.0, 15.5, 8.3, 16.7, 15.2, 12.2)
Pinus ponderosa	25.6 (25.6)

LITERATURE CITED

Mueller-Dombois, D., and H. Ellenberg.
1974. Aims and methods of vegetation ecology. Wiley, New York. 547 p.

Sawyer, J. O., D.A. Thornburgh, and J. R. Griffin
1977. Mixed evergreen forest. In, M. G. Barbour and J. Major. (eds.) Terrestrial vegetation of California. Wiley, New York. 1000 p.

APPENDIX

Appendix 1. Taxa recognized within the proposed William's Point Research Natural Area. Collected plants were identified using the facilities of the Humboldt State University Herbarium (HSC). Vouchers are deposited there. Nomenclature mainly follows P. Munz. 1959, A California flora. University of California Press, Berkeley. 1681 p.

Aceraceae

Acer macrophyllum Pursh.

Anacardiaceae

Toxicodendron diversiloba T. & G.

Apocynaceae

Apocynum pumilum (Gray) Greene

Aristolochiaceae

Asarum hartwegii Wats

Aspidiaceae

Cystopteris fragilis (L.) Bernh.

Dryopteris arguta (Kaulf.) Watt

Polystichum imbricans

Polystichum munitum (Kaulf.) Presl.

Berberidaceae

Achlys triphylla Sm. DC.

Berberis aquifolium Pursh.

Berberis nervosa Pursh.

Berberis pinnata Lag.

Vancouveria planipetala Calloni.

Betulaceae

Alnus rhombifolia Nutt.

Corylus cornuta Marsh var. *californica* (A.DC.) Sharp.

Blechnaceae

Woodwardia fimbriata Sm. in Rees.

Campanulaceae

Campanula prenanthoides Durand

Caprifoliaceae

Lonicera ciliosa (Pursh) Poir

Lonicera hispidula Dougl. var. *vacillans* Gray.

Symphoricarpos hesperius G.N. Jones.

Symphoricarpos mollis Nutt. in T.& G.

Compositae

Adenocaulon bicolor Hook.

Arnica mollis Hook.

Balsamorhiza deltoidea. Nutt.

Centaurea solstitialis L.

Eriophyllum lanatum (Pursh.) Forbes

Helenium puberulum D.C.

Hieracium albiflorum Hook

Lessingia nemaclada Greene

Madia elegans D. Don

Madia madioides (Nutt.) Greene

Cornaceae

Cornus nuttallii Aud.

C. grassulacea

Sedum laxum (Britton) Berger

Sedum stenopetalum Pursh.

Cruciferae

Arabis modesta Roll.

Cupressaceae

Calocedrus decurrens Torr.

Ericaceae

Arbutus menziesii Pursh.

Arctostaphylos manzanita Parry

Fagaceae

Lithocarpus densiflora (H. & A.) Rehd.

Quercus chrysolepis Liebm.

Quercus garryana Dougl.

Quercus Kelloggii Newb.

Gramineae

Aira praecox L.

Bromus inermis Leyss

Bromus rigidus Roth.

Festuca idahoensis Elmer

Leersia oryzoides (L.) SW.

Melica bulbosa Geyer ex. Porter & Coult.

Hypericaceae

Hypericum perforatum L.

Iridaceae

Iris tenax Dougl.

Juncaceae

Juncus sp.

Labiatae

Lycopus americanus Muhl.

Monardella odoratissima Benth.

Prunella vulgaris L.

Satureja douglasii (Benth.) Brig.

Trichostema lanceolatum Benth.

Leguminosae

Lathyrus polyphyllus Nutt. ex T. & Gr.

Lotus purshianus (Benth.) Clem. & Clem.

Lotus suppinnatus Lag.

Lupinus latifolius J. A. Agardh.

Vicia americana Muhl. ssp. oregana (Nutt.)

Abrams

Liliaceae

Disporum hookeri (Torr.) Nichols

Lilium washingtonianum Kell.

Trillium ovatum Pursh.

Malvaceae

Sidalcea oregana (Nutt.) Gray var.

maxima (Peck) C. L. Hitchc.

Onagraceae

Circaea alpina L. var. *pacifica*

(Asch. & Magnus) Jones

Epilobium glaberrimum Barb.

Orchidaceae

Cypripedium fasciculatum Kell.

Goodyera oblongifolia Raf.

Habenaria unalascensis (Spreng.) Wats.

Pinaceae

Pinus lambertiana Dougl.

Pinus ponderosa Dougl. ex. P.&C.Lawson

Pseudotsuga menziesii (Mirb.) Franco

Polygonaceae

Eriogonum nudum (Benth. ex. Dougl.) S. Stokes.

Polygonum californicum Meissen.

Polypodiaceae

Polypodium californicum Kaulf.

Primulaceae

Trientalis latifolia Hook.

Pteridaceae

Pityrogramma triangularis (Kaulf.) Maxon.

Pteridium aquilinum (L.) Kuhn.

Pyrolaceae

Pyrola picta Sm. forma *aphylla* (Sm.) Camp

Rhamnaceae

Ceanothus integerrimus H. & A. var. *californicus* (Kell.) G. T. Benson

Rosaceae

Amelanchier florida Lindl.

Amelanchier pallida Greene.

Cercocarpus betuloides Nutt. ex. T. & Gr.

Fragaria californica Cham. & Schlecht.

Holodiscus discolor (Pursh.) Maxim.

Malus fusca (Raf.) C. K. Schneid

Physocarpus capitatus (Pursh.) Kuntze

Rosa eglanteria L.

Rosa gymnocarpa Nutt. ex. T. & Gr.

Rosa nutkana Presl.

Rubus parviflorus Nutt.

Rubus procerus P. J. Muell.

Rubus vitifolius Cham. & Schlecht.

Rubiaceae

Galium bolanderi Gray.

Galium triflorum Michx.

Salicaceae

Salix scouleriana Barr.

Santalaceae

Comandra pallida DC.

Saxifragaceae

Heuchera micrantha Doug. ex Lindl.

Philadelphus lewisii Pursh ssp. *californicus* (Benth.) Munz.

Ribes roezlii Regel.

Tellima grandiflora (Pursh.) Dougl.

Whipplea modesta Torr.

Scrophulariaceae

Cordylanthus viscidus (Howell) Penn.

Selaginellaceae

Selaginella wallacei Hieron.

Taxaceae

Taxus brevifolia Nutt.

Umbelliferae

Daucua coroth L.

Ligusticum californicum Coult. & Rose

Osmorhiza Chilenis H. & H.

Perideridia gairdneri (H. & H.) Math.

Violaceae

Viola glabella Nutt.